

Original Article

Emergency care capacity in Africa: A clinical and educational initiative in Tanzania

Teri A. Reynolds^{a,b,c,*}, Juma A. Mfinanga^{a,b}, Hendry R. Sawe^{a,b}, Michael S. Runyon^d, and Victor Mwafongo^{a,b}

^aEmergency Medical Department, Muhimbili National Hospital, Dar es Salaam, Tanzania.

^bSchool of Medicine, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania.

^cDepartment of Emergency Medicine, School of Medicine, and Global Health Sciences, University of California San Francisco, 505 Parnassus Avenue, San Francisco, CA 94143-0208, USA.

E-mail: teri.reynolds@ucsf.edu

^dDepartment of Emergency Medicine, Carolinas Medical Center, Charlotte, USA.

*Corresponding author.

Abstract Even though sub-Saharan Africa faces a disproportionate burden of acute injury and illness, few clinical facilities are configured to take an integrated approach to resuscitation and stabilization. Emergency care is a high-impact and cost-effective form of secondary prevention; disease surveillance at facilities delivering acute and emergency care is essential to guide primary prevention. Barriers to emergency care implementation in the region include limited documentation of the acute disease burden, a lack of consensus on regionally appropriate metrics to facilitate impact evaluation, and the lack of coordinated advocacy for acute disease prevention and emergency care. Despite these challenges, interest in creating dedicated acute care facilities and emergency training programs is rapidly expanding in Africa. We describe one such initiative at Muhimbili National Hospital in Dar es Salaam, with a focus on the development of the emergency medicine residency program.

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Emergencies occur everywhere, and each day they consume resources regardless of whether there are systems capable of achieving good outcomes.

Kobusingye *et al*, Bulletin of WHO¹

Introduction

This article briefly reviews the need for emergency care in Africa and barriers to its integration into health systems in the region. We describe an example of an emergency care initiative at Muhimbili National Hospital (MNH) in Dar es Salaam that has integrated a multi-cadre training program with development of a dedicated emergency department in the largest public hospital in Tanzania. We focus on the development of an emergency medicine residency program within this initiative. This article should be of interest to those concerned with prevention and treatment of acute illness in the sub-Saharan region, and those with a particular interest in global emergency care and physician training initiatives in resource-limited settings.

Background

Low-income countries suffer the highest rates of every category of injury – from road traffic to drowning; the highest rates of maternal death from acute complications of pregnancy; and the highest rates of acute complications of communicable diseases including tuberculosis, malaria, and HIV.² The rapidly growing prevalence of cardiovascular and diabetic disease has only increased the burden of acute illness, as patients with chronic disease in low-income countries also have the highest rates of mortality from acute complications.^{3,4} The Disease Control Priorities in Developing Countries project estimates that 45 per cent of deaths and 36 per cent of Disability-Adjusted Life Years (DALYs) in low- and middle-income countries could be addressed by the implementation of emergency care systems.⁵

While definitive specialty care will never be available at all times in all places, several studies suggest that emergency care is an effective and cost-effective means of secondary prevention: prioritizing an integrated approach to early resuscitation and stabilization of acutely ill patients greatly reduces the morbidity and mortality associated with a range of

medical, surgical, pediatric, and obstetric conditions.^{5–11} In addition, many acute conditions can be mitigated by primary prevention; disease surveillance at acute and emergency care facilities has been shown to increase preparedness and disease control capabilities.^{10,12} In general, analysis of acute disease patterns and the distribution of mortality across the acute care continuum is a crucial part of identifying the preventive and training initiatives most likely to improve outcomes.^{13–17} Facility-based and pre-facility emergency care are essential components of a continuum ranging from prevention, through primary and chronic care, to inpatient critical care and surgery, and with Resolution 60.22 the World Health Assembly has called for all its member states to consider ‘formal, integrated emergency care systems’.¹⁸

Challenges to Implementation

There are four foundational challenges to integrating emergency care into health systems in sub-Saharan Africa:

1. *The burden of acute disease in sub-Saharan Africa is severely under-documented.* Some data exist on the distribution of inpatient diagnoses in the region, but the actual range of acute presentations to health facilities is largely unknown. Studies that compare police, hospital, and insurance records with other sources in low-income countries, for example, suggest that as few as 1 in 10 injuries may be documented in official counts.^{19–22}
2. *Health-care facilities often lack an integrated approach to triage, resuscitation, and stabilization of acutely ill patients.* Even at a single small district hospital, acutely ill patients may be cared for by several different departments, depending on age, pregnancy status, and specific disease states. This vertical approach means that there is rarely a dedicated acute intake area staffed with nonrotating personnel who can be trained in resuscitation and stabilization.
3. *Essential components of acute and emergency care have not been determined, and there is no consensus on how to define success.* To date, there has been no systematic analysis of the acute care delivery systems most appropriate to these varied contexts. While there are scattered examples of successful interventions, little is known about what makes these programs effective or how others might replicate their success. Impact is often quantified by the



number of providers trained, rather than by any measure that incorporates quality or performance assessment.

4. *There is no current advocacy plan for placing emergency care on the global health agenda.* Despite the essential role of early resuscitation and stabilization in averting morbidity and mortality, emergency care is conspicuously absent from discussions of global health priority initiatives (such as the Millennium Development Goals and UN consensus statements) and large-scale global health funding strategies.

Despite these challenges, interest in emergency care training is rapidly expanding in Africa, and there are planned or established emergency training programs for specialists in Botswana, Ethiopia, Ghana, Kenya, Liberia, Rwanda, South Africa, Sudan, Tanzania, and Uganda; and for other provider cadres in Ghana, Tanzania, South Africa, and Uganda. We review one such initiative at MNH in Dar es Salaam, with a focus on the development of the emergency medicine residency program.

The MNH Emergency Medical Department (EMD), Tanzania

The United Republic of Tanzania is designated as a low-income country with an estimated population of 46 million, a per capita income of around US\$500, and an average life expectancy of 51.²³ More than three quarters of the population lives in rural areas and a third lives below the poverty line. The infant mortality rate is around 51 per 1000 population,²³ and there are approximately 3 doctors and 39 nurses and midwives per 100 000 population.²⁴

In January 2010, MNH opened Tanzania's first dedicated public emergency department via a public-private partnership between Tanzania's Ministry of Health and Social Welfare (MOHSW), and Abbott Fund Tanzania. The MNH EMD is fully staffed with physicians (*registrars* have completed medical school and internship, whereas *residents* have worked as registrars and are now pursuing specialty training) and nurses 24 hours per day and currently sees 100–130 patients daily, or approximately 40 000 patients per year. The department has full resuscitation capacity, and to add to the main hospital-operating suite a single-room operating theater dedicated to emergency

Table 1: Muhimbili National Hospital Emergency Medical Department statistics compared with national rates

	<i>MNH EMD (%)</i>	<i>Tanzania (%)</i>
Female	39	50 ²⁵
Under 18	25	51 ²⁵
Under 5	13	18 ²⁵
Injury (overall)	25 (as percentage of total patients) 14% under 5 years, 20% under 18 years	8 (as percentage of total 2004 DALYs) ²⁶

Source: unpublished Muhimbili National Hospital 2010 data.

cases has recently been opened within the EMD. A business plan to ensure the department's financial sustainability has just been finalized through an agreement between the hospital, the ministry, and Abbott Fund Tanzania.

Nearly 40 per cent of MNH EMD patients are female, 25 per cent are under 18 years of age, and 13 per cent are under 5 years of age (Table 1). Approximately, one quarter of all patients and 20 per cent of pediatric patients present with injuries. In adults, intracranial injuries are very common, and road traffic is a very common cause of injury in adults and children. Other common diagnoses in adults and children include anemia and infections, particularly pneumonia in children. Mental illness is also a top diagnosis in adults, with the majority of these patients presenting with psychosis.

Emergency Provider Training at Muhimbili

While the Muhimbili EMD project began as an infrastructure-development initiative, the necessity for a coordinated professional development strategy emerged early – at the time the EMD opened, there were no emergency physicians in Tanzania and no dedicated emergency care nurse training programs. Abbott Fund Tanzania initiated and supports an academic collaboration among United States (US), South African, and Canadian institutions to provide clinical training for nurses and physicians, with the goal of ensuring long-term sustainability of the Muhimbili EMD and training leaders to promote, disseminate, and sustain emergency care throughout Tanzania. Via this program, the EMD providers are supported by international emergency nursing and emergency physician faculty year round. Visiting faculty



serve minimum 1-month stints, and there is an emergency medicine residency program director from the University of California San Francisco onsite for the majority of the year (Author TR). The collaboration has developed site-specific training materials for a 10-module nursing curriculum, a 1-year registrar program, and a 3-year residency program. Ninety per cent of nursing staff have completed the program; 15 registrars have filed to complete the 1-year emergency care credentialing process; and the first class of eight residents and second class of six residents will be joined by a third class this fall. The first residency cohort will graduate in July 2013, and leadership of the program will transition to local faculty by the end of 2014.

Evolution of the Emergency Medicine Residency at Muhimbili

The program at Muhimbili is the nation's only emergency medicine residency and is fully integrated into the Muhimbili University of Health and Allied Sciences (MUHAS) Master of Medicine (MMed) track. The initial curriculum was developed and implemented in a collaboration between the MNH Head of Department and the US emergency medicine faculty serving as Abbott Fund Tanzania consultants. The curriculum was subsequently revised as part of a university-wide initiative to introduce a competency-based format.²⁷ At the time of the curriculum development, the International Federation for Emergency Medicine Model curriculum²⁸ had not been released, but we have since conducted a curricular review to ensure that our curriculum meets its guidelines.

Residents currently spend approximately half their time in the EMD itself, and half on outside rotations in other clinical departments relevant to the practice of emergency medicine, such as surgery, obstetrics–gynecology, cardiology, orthopedics, and pediatrics. All exams and performance evaluations are executed by emergency medicine faculty. The competency-based curriculum guides evaluation and allows resident performance to be appraised with reference to context-oriented proficiency, rather than traditional, discipline-based evaluation. This mode of targeted learning is particularly appropriate to the broad, setting specific practice of emergency medicine – especially as a newly established field – where the transmission of a culture of practice is as essential as the transmission of a body of scientific knowledge.

The program is monitored by a combination of resident examinations and other provider performance metrics. Each semester residents undergo a multidimensional evaluation including a written multiple-choice exam, a written essay exam, an oral case-based exam, and an observed clinical exam (with case presentation) on volunteer hospitalized patients. Exams are proctored by local faculty and international outside examiners approved by the university academic senate. Performance gaps are recorded and addressed in subsequent review sessions, and any gaps shared by multiple residents trigger review of the relevant component of the didactic and off-service curriculum. In addition, all doctors, nurses, and health attendants undergo regular professional performance audits that evaluate on-time attendance, room-response times, and documentation quality. The EMD operations team is currently specifying metrics to evaluate throughput times, triage performance, and resuscitation process. Emergency residents have also agreed to participate in a 10-year tracking study, which currently surveys their experiences on off-service rotations, and will continue to track their practice sites and the disease burden they encounter over the next decade.

In general, medical trainees in Tanzania face an extraordinary burden of disease and take on a degree of individual responsibility that rarely if ever falls on their US counterparts. The ratio of patients to providers is daunting, and the ratio of faculty to residents in most specialties is simply not adequate to the supervision and training needs. Whereas this latter condition is mitigated to some extent by the visiting faculty in the Muhimbili emergency program, other challenges result from the acuity of the specialty and its nascent status.

Managing dynamically evolving, unstable patients is new to most trainees as their previous clinical training was often in settings with limited resources for intervening with critically ill patients (who usually died). For now, emergency residents also face the challenge of being taught and supervised by faculty who have not been trained within the same system. Although they are guided by faculty in clinical decision making, ultimately the residents themselves are charged with developing the practice of regionally specific emergency care as they build their individual funds of knowledge. They frequently serve as advisors and teachers for each other, and are often in the position of researching a condition as they treat it in a patient.

On rotations in other departments, besides mastering the clinical content of that respective specialty, the emergency residents must serve



as ambassadors and educate others as to the nature of their own specialty and their learning goals. As the first and only emergency physicians in the country, they are called into institutional and political service to a degree that only a handful of their international colleagues will experience much later in their careers. Even in terms of the scientific advancement of the specialty, these residents have an extraordinary charge. Because the residency confers a MMed degree, each resident completes a dissertation. Because the burden of acute disease is so poorly documented in the region, many of these dissertations will be the first, and for a time the definitive literature on the topic.

Although the practice of emergency medicine has indeed ‘evolved during the past 40 years into a coherent global discipline with a unique set of cognitive, technical, and administrative skills for managing acute illness or injuries,’¹⁰ there remain notable differences in the scope of practice required of providers in low-income countries. Simple translation of curricular content from other regions is unlikely to prepare trainees for what they will face during training and after graduation. Acute care facilities serve to fill many gaps in the health systems of low-income countries, and providers at facilities distant from referral centers may be required to perform tasks considered beyond the scope of emergency specialists in other countries, such as basic obstetric, abdominal, and orthopedic surgeries. In this context, off-service rotations serve a different role than they might in areas where consultants are expected to be accessible within minutes to hours. As much as possible, informed by interviews with local providers who have worked in district and sub-district facilities, we have adapted the content of our curriculum to accommodate this reality (either by EMD-based or off-service training). In addition, to ensure that our curriculum is appropriate to the local disease burden, we are currently analyzing diagnostic and demographic data from the first 2 years of the MNH EMD, and the 2013 curriculum will be adjusted based on these results and other emerging regional data.²⁹ Eventually, we hope that the results of our physician tracking study will also serve to inform future emergency care curricula at Muhimbili and elsewhere.

National, Regional, and International Networking Efforts

In an effort to advocate for the dissemination of high-quality emergency care in Tanzania, Muhimbili providers formed the Emergency Medicine

Association of Tanzania (EMAT), the first emergency medicine professional organization in the region. EMAT was ratified by the ministry in May of 2011 with the mandate to:

- Promote and improve emergency care through teaching, research, and education.
- Advocate for and provide emergency care across Tanzania.
- Collaborate with other emergency care research and educational organizations, regardless of location, to the benefit of emergency care in Tanzania.

With the approval of the MOHSW, a research team including the authors (TR, HS, JM) and other EMAT members has just completed site visits to every district hospital in Tanzania to assess emergency care capacity. The results will serve to guide future emergency care planning and development, as well as prevention initiatives. Other ongoing EMAT projects include expanding the registrar training program to accommodate visiting stints by district hospital providers; onsite training of district hospital providers in regionally appropriate basic and advanced resuscitation and trauma management skills; the development of a transport medicine skills course; and a series of needs analysis studies that will facilitate the development of coordinated pre-hospital emergency services. In addition, EMAT aims to expand collaboration with other emergency provider training efforts in Arusha, Bugando, Moshi, and Zanzibar³⁰ and has begun an exchange of site visits and planned collaborative training projects. To amplify and support its national efforts, EMAT has affiliated with the African Federation for Emergency Medicine and the International Federation for Emergency Medicine, and plans are underway to establish an East African emergency medicine federation that will allow resource-sharing and coordination of research and training efforts. The first East African regional meeting on emergency care is planned for December 2012.

Conclusions

Sub-Saharan Africa faces a disproportionate burden of acute disease and many challenges to meeting the call of World Health Assembly Resolution 60.22 for formal integrated emergency care systems. The Abbott Fund Tanzania-supported program at MNH in Dar es Salaam represents one effort to integrate a multi-cadre professional development



strategy with the establishment of a high-volume emergency care facility. The MUHAS-based residency will soon enroll its third class and will produce its first graduates in 2013. Their and others' future efforts will benefit from greater national and regional coordination to allow multi-site research and surveillance and sharing of educational resources. EMAT has been formed to help expand regional and global advocacy efforts in collaboration with the African and International Federations for Emergency Medicine.

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About the Authors

Teri Reynolds, MD, MS, PhD, is an Assistant Professor and Director of Global Health in the Department of Emergency Medicine at UCSF, and an Honorary Lecturer at MUHAS. She lives in Dar es Salaam where she directs the Muhimbili emergency medicine residency program.

Juma Mfinanga, MD, is a Chief Resident in emergency medicine at MUHAS and the General Secretary of the Emergency Medicine Association of Tanzania. His research interests include injury care and prevention, disaster response, and emergency care at the district level.

Hendry Sawe, MD, is a Chief Resident in emergency medicine at MUHAS and the President of the Emergency Medicine Association of Tanzania. His research interests include ultrasound, critical care, and emergency care at the district level.

Michael Runyon, MD, is an Associate Professor of emergency medicine and the Director of global emergency medicine at Carolinas Medical Center. He has consulted on the emergency department and residency at Muhimbili since their inception.

Victor Mwafongo, MD, MMed, is an Associate Professor in the Department of Anaesthesiology and the Head of the Emergency Medical Department at Muhimbili National Hospital. He is the founding head of the Emergency Medicine Unit at MUHAS.

References

1. Kobusingye, O.C., Hyder, A.A. and Bishai, D. *et al* (2005) Emergency medical systems in low- and middle-income countries: Recommendations for action. *Bulletin of the World Health Organization* 83(8): 626–631.
2. Jamison, D. *et al* (eds) (2012) Disease control priorities in developing countries – NCBI bookshelf, <http://www.ncbi.nlm.nih.gov/books/NBK11728/>, accessed 15 August 2012.
3. Mbugua, P.K., Otieno, C.F., Kayima, J.K., Amayo, A.A. and McLigeyo, S.O. (2005) Diabetic ketoacidosis: Clinical presentation and precipitating factors at Kenyatta National Hospital, Nairobi. *East African Medical Journal* 82(12 Supplement): S191–S196.
4. Desta, T. (1992) Diabetic ketoacidosis in an Addis Abeba children's hospital. *Ethiopian Medical Journal* 30(1): 7–11.
5. Kobusingye, O.C. (2012) Emergency medical services – Disease control priorities in developing countries – NCBI bookshelf, <http://www.ncbi.nlm.nih.gov/books/NBK11744/>, accessed 15 August 2012.
6. Jacob, S.T., Banura, P. and Baeten, J.M. *et al* (2012) The impact of early monitored management on survival in hospitalized adult Ugandan patients with severe sepsis: A prospective intervention study. *Critical Care Medicine* 40(7): 2050–2058.
7. Miller, S., Lester, F. and Hensleigh, P. (2004) Prevention and treatment of postpartum hemorrhage: New advances for low-resource settings. *J Midwifery Womens Health* 49(4): 283–292.
8. Ersdal, H.L., Mduma, E., Svensen, E. and Perlman, J.M. (2012) Early initiation of basic resuscitation interventions including face mask ventilation may reduce birth asphyxia related mortality in low-income countries: A prospective descriptive observational study. *Resuscitation* 83(7): 869–873.
9. Husum, H., Gilbert, M., Wisborg, T., Van Heng, Y. and Murad, M. (2003) Rural prehospital trauma systems improve trauma outcome in low-income countries: A prospective study from North Iraq and Cambodia. *Journal of Trauma* 54(6): 1188–1196.
10. Anderson, P.D., Suter, R.E. and Mulligan, T. *et al* (2012) World Health Assembly Resolution 60.22 and its importance as a health care policy tool for improving emergency care access and availability globally. *Annals of Emergency Medicine* 60(1): 35–44.e3.
11. Razzak, J.A. and Kellermann, A.L. (2002) Emergency medical care in developing countries: Is it worthwhile? *Bulletin of the World Health Organization* 80(11): 900–905.
12. Wu, T.-S.J., Shih, F.-Y.F. and Yen, M.-Y. *et al* (2008) Establishing a nationwide emergency department-based syndromic surveillance system for better public health responses in Taiwan. *BMC Public Health* 8: 18.
13. Roudsari, B.S., Shadman, M. and Ghodsi, M. (2006) Childhood trauma fatality and resource allocation in injury control programs in a developing country. *BMC Public Health* 6: 117.
14. Mock, C.N., Jurkovich, G.J., nii-Amon-Kotei, D., Arreola-Risa, C. and Maier, R.V. (1998) Trauma mortality patterns in three nations at different economic levels: Implications for global trauma system development. *Journal of Trauma* 44(5): 804–812.
15. Filippi, V., Richard, F., Lange, I. and Ouattara, F. (2009) Identifying barriers from home to the appropriate hospital through near-miss audits in developing countries. *Best Practice & Research Clinical Obstetrics & Gynaecology* 23(3): 389–400.



16. Kirsch, T.D., Beaudreau, R.W., Holder, Y.A. and Smith, G.S. (1996) Pediatric injuries presenting to an emergency department in a developing country. *Pediatric Emergency Care* 12(6): 411–415.
17. Lin, M.-R. and Kraus, J.F. (2009) A review of risk factors and patterns of motorcycle injuries. *Accident Analysis & Prevention* 41(4): 710–722.
18. World Health Organization: Sixtieth World Health Assembly. (2007) *Resolution WHA 60.22: Emergency-care Systems*. Geneva, Switzerland: World Health Organization, http://www.who.int/gb/ebwha/pdf_files/WHA60/A60_R22-en.pdf.
19. Razzak, J.A. and Luby, S.P. (1998) Estimating deaths and injuries due to road traffic accidents in Karachi, Pakistan, through the capture-recapture method. *International Journal of Epidemiology* 27(5): 866–870.
20. Lu, T.H., Lee, M.C. and Chou, M.C. (1998) Trends in injury mortality among adolescents in Taiwan, 1965–1994. *Injury Prevention* 4(2): 111–115.
21. Ameratunga, S., Hajar, M. and Norton, R. (2006) Road-traffic injuries: Confronting disparities to address a global-health problem. *Lancet* 367(9521): 1533–1540.
22. World Health Organization. (2012) Directory of resources on transport, health and environment in developing countries. WHO, <http://www.who.int/heli/risks/urban/transpdirectory/en/index6.html>, accessed 15 August 2012.
23. National Bureau of Statistics Tanzania and ICF Macro. (2011) *Tanzania Demographic and Health Survey 2010*, Dar es Salaam, Tanzania, 2010, <http://www.measuredhs.com/publications/publication-fr243-dhs-final-reports.cfm>, accessed 2 September 2012.
24. Ministry of Health and Social Welfare Tanzania Mainland and Ministry of Health and Social Welfare Zanzibar. (2006) Tanzania service availability mapping 2005–2006. Dar es Salaam.
25. United Nations Children's Fund. (2012) UNICEF – Tanzania, United Republic of – statistics, http://www.unicef.org/infobycountry/tanzania_statistics.html, accessed 2 September 2012.
26. World Health Organization Global Health Observatory. (2012) WHO: United Republic of Tanzania: country profiles. *General Health Statistical Profile*, http://www.who.int/healthinfo/global_burden_disease/estimates_country/en/index.html, accessed 18 October 2012.
27. Ngassapa, O.D. *et al* (2012) Curricular transformation of health professions education in Tanzania: The process at Muhimbili University of Health and Allied Sciences (2008–2011). *Journal of Public Health Policy* 33(S1): S64–S91.
28. International Federation for Emergency Medicine. (2011) International Federation for Emergency Medicine model curriculum for emergency medicine specialists. *CJEM* 13(2): 109–121.
29. Casey, E.R., Muro, F. and Thielman, N.M. *et al* (2012) Analysis of traumatic injuries presenting to a referral hospital emergency department in Moshi, Tanzania. *International Journal of Emergency Medicine* 5(1): 28.
30. Nicks, B.A., Sawe, H.R., Juma, A.M. and Reynolds, T.A. (2012) The state of emergency medicine in the United Republic of Tanzania. *African Journal of Emergency Medicine* 2(3): 97–102.



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